

Title: Let the Games Begin

Brief Overview:

Students will participate in "Olympic" games within the classroom, and create a glyph flag for their team using criteria provided. Students will work cooperatively in groups to estimate time, distance, volume, and area and then determine actual data through participation in the games. Data will be recorded on a self-correcting score sheet and students will use this data to individually construct a double bar graph comparing the actual and estimated data.

Link to Standards:

- **Problem Solving** Students will demonstrate their ability to solve mathematical problems through the use of open ended answers, cooperative group work, and technology. Students will also develop and apply a variety of strategies to solve problems and to analyze and interpret data.
- **Communication** Students will use oral, written, and graphic methods to convey their ideas. Students will interpret and evaluate their results through discussions and written responses.
- **Reasoning** Students will understand and apply reasoning processes through the use of graphs, spatial reasoning, and inductive and deductive thinking. Students will gather evidence and data to support estimated answers.
- **Connections** Students will investigate problems and describe results using graphical, numerical, physical, and verbal models or representations. Students will be able to incorporate the areas of art, social studies, and science into this activity.
- **Number Relationships** Students will choose appropriate operations to solve a problem. Students will demonstrate their ability to describe and apply number relationships using concrete materials. Students will demonstrate their ability to apply estimation strategies to solve problems.
- **Geometry/ Measurement** Students will demonstrate their ability to apply geometric concepts using two-dimensional and three-dimensional shapes. The students will apply the concept of symmetry to solve a problem. Students will estimate and verify measurements using metric units.
- **Statistics** Students will demonstrate their ability to collect, organize, and display data. Students will use appropriate displays such as line plots, glyphs, and double bar graphs

Grade/Level:

Grades 4 and 5

Duration/Length:

This lesson will take 5 or 6 periods (60 min.).

Prerequisite Knowledge:

Students should have working knowledge of the following skills:

- Estimation
- Determination of area and volume
- Metric measurement (linear and mass)
- Graphing skills
- Symmetry
- Definition of polygon
- Use of compass
- Application of radius and diameter

Objectives:

Students will:

- use estimation techniques.
- work cooperatively in groups.
- compute area and volume.
- determine length and distance using metric measurement.
- use a glyph to represent a group flag.
- construct a double bar graph and incorporate all elements.
- construct a flag using a symmetrical polygon.
- use a compass to construct a circle with a given radius.
- determine mass of given objects.
- construct a line plot and incorporate all elements.

Materials/Resources/Printed Materials:

- Graph paper
- Ruler
- Calculator
- Timer or clock with a second hand
- Meter stick or tape measures
- Pint milk cartons
- Masking tapes
- Art supplies (paper, markers, scissors, etc.)
- Compass
- A playground ball
- Cm graph paper
- Calculators
- Paper clips
- Pencils
- Scale/balance
- Pennies and nickels
- Chart paper

Development/Procedures:

Day 1:

Materials:

SR #1	construction paper
scissors	glue
markers/crayons	compasses
rulers	models of space figures and plane figures

- Motivate the students by sharing newspaper articles, literature books, or other visuals related to sports, games or other competitive events. Lead into a discussion about the upcoming activities. Share some information about the types of activities the students will be participating in, the "games/Olympics" theme, and the purpose of reviewing estimating skills in a fun format. Remind students that although they will be playing game, they will be held accountable for math and writing skills.
- Review the concepts and model examples of volume and area using space and plane figures. Present several examples where students can experiment with counting square units and cubic units to determine area and volume.
- Review appropriate vocabulary (circle, radius, diameter, types of polygons, etc.) and have students record definitions in their math journals.
- Assign teams for the next day's events. Explain that each team is to create an original country name and design a flag to represent their country. Distribute directions and materials to each team for the construction of the team flag. (Student Resource 1)

Day 2:

- Prepare a packet for each student that contains directions for each of the five stations and the score sheet (SR #2-8) and organize each station with all necessary materials ahead of time.
- Students should present their flags and country names to the class. They should discuss what elements to include before the presentation (i.e., population, location, climate, reasons for selection, etc.). This should be a brief presentation.
- Explain the procedure for moving between the five stations discussing expectations and guidelines for each activity. Discuss the purpose of estimating in each activity and model how to find the actual and estimated results and the difference between them.
- Review the importance of carefully reading the assessment questions that follow each activity and answering them completely. Model this procedure using similar questions about a scenario that may or may not be related to the games theme.
- Discuss the score sheet (SR #8) and how to transfer the data from the activity sheet to the score sheet. The object is to get the lowest total score of differences. Depending on the class, the teacher may decide to have a winning team or individuals.

Activity 1: *Sugar Drop*

Students will estimate the number of sugar cubes that will fit into a pint sized container. Students will use problem solving techniques to find the actual volume of sugar cubes needed. Estimated and actual results will be transferred to the score sheet.

Materials:

sugar cubes
pint containers

Activity 2: *Dare to Dribble*

Students will estimate the number of times they can bounce a ball in one minute. A partner will keep time and count the number of bounces for each student. All results will be transferred to the scoring sheet.

Materials:

ball
timer/watch with second hand

Activity 3: *Long Jump*

Determine a starting line and jumping area with masking tape. Students should stand at the starting line and estimate in centimeters how far they think they will jump. Students will take turns jumping with both feet and the jumps will be marked with tape. Each student will then measure the actual length of his or her jump and record the results. Tape measures, meter sticks or a trundle wheel may be used.

Materials:

masking tape
meter stick, tape measure or trundle

Activity 4: *High Fives*

Students will estimate the area in centimeters of their hand. They will record the estimate and then trace their hand on a piece of centimeter graph paper. They should use various problem solving strategies to find the actual area and record the results.

Materials:

cm graph paper

Activity 5: *Olympic Medal Weight*

Students will estimate the weight of "silver" and "bronze" medals (nickels and pennies) and then use a scale to weigh them. The teacher will select an appropriate number of "medals". All results will be recorded on the score sheet.

Materials:

nickels
pennies
scale/balance

Day 3:

Materials:

completed activity packets	calculators
medals	TR #9
SR #10	

- Distribute completed activity packets to students.
- Call on students to share the results of their investigation. Allow time to have students reflect on their answers.
- Use calculators or paper and pencils to add the total differences found on the individual activity sheets. The student that receives the lowest total score wins. (Remind students that their goal was to become better estimators which means that the estimated answer should be as close to the actual score as possible).
- Distribute medals to those students who placed first, second, and third. Teacher may choose to use the medals that the students created for homework.
- Construct a sample double-bar graph with the class. (See Teacher Resource #9 for a sample.) Review the necessary elements for constructing the double-bar graph. Students should think about: Title, labels correctly placed, and key. Have the students discuss what conclusions they would gather from this graph. [Model for descriptive paragraphs.]
- Use student's individual data collected to compare the estimated versus actual answers. Students will display this information on a double-bar graph (SR #10). Have students write short descriptive paragraphs about their graph.

Day 4:

Materials:

chart paper	journals
SR #6	TR #11

- Review the elements of a line plot with the students and have them label a sample on the chalkboard. (See Teacher Resource #11 for a sample.) Have the students discuss what conclusions they could gather from this line plot.

- Present a blank line plot on bulletin board paper and explain to the students that they will be using their "High Five" hand drawings to create a class line plot. Elicit from the students that this will show an overall picture of hand sizes for the class.
- Tally the data for hand sizes and number of students. Use this data to determine the scale for the line plot. Select students to label the line plot and title it.
- Place the cut out hands from Student Resource Sheet 6 on the appropriate section of the line plot after they have been colored, cut out and labeled with student names.
- Discuss the results of the line plot and possible reasons for those results.
- Use math journals to record personal interpretations and data analysis.

Day 5:

- Review the elements of a friendly letter with the students and distribute Student Resource #12, *Writing a Friendly Letter*. Students should complete this task independently. This task will assess their understanding of estimation and its applications in math and real life. Use the rubric on Teacher Resource #13 as a scoring tool.

Performance Assessment:

Assessment of student progress is ongoing throughout this unit. Included on the activity pages are reflection questions for the students to respond to as they complete each event. Teacher Resource #14 is a rubric for assessing the glyph/flag that each team creates on the first day. At the end of the unit, students should complete the letter writing assignment. This will enable the teacher to assess the students' knowledge and understanding of the estimation skills used. Teacher Resource #13 is a rubric for assessing the letter. Students will be expected to work cooperatively in groups throughout this unit, displaying appropriate behavior and completing all assignments. Teacher Resource #15 is a rubric for evaluating group interaction.

Extension/Follow Up:

1. Design a winning medal as a homework assignment.
2. Classroom parade of flags.
3. As a group, design an original activity/game.
4. Design a travel brochure for the team's fictitious country.
5. Create an original Olympic trivia game using a variety of resource materials.

Authors:

Lisa Blandford
Point Pleasant Elementary School
Anne Arundel County, MD

June Gentilcore
Stone Ridge Country Day School
Montgomery County, MD

Jacqueline Rago
Phyllis E. Williams Academic Center
Prince George's County, MD

Wendy Ingalls
Shady Spring Elementary School
Baltimore County, MD

Competitor _____

Team Name _____

Design an Olympic Flag

You are going to design a glyph that will become your team's flag representing your country. The cut out shape of your flag must be a regular polygon that is symmetrical. Be sure to include your original country's name on the flag.

You must first construct five overlapping circles, each with a radius of 2.5 cm. Complete your flag using the following criteria:

1. If more than 1/2 of your group is boys, draw a triangle in one of your circles. If more than 1/2 are girls, draw a rhombus on your flag.
2. If everyone in your group is the same age, draw a parallelogram in another circle on your flag. If not, draw a square.
3. If anyone in your group is left-handed, draw a hexagon in another circle on your flag. If not, draw a pentagon.
4. If you have a bird, draw an octagon in a circle on your flag. If not, draw a rectangle.
5. If your entire group has attended this school since kindergarten, draw a trapezoid in the last circle on your flag. If not, draw a decagon.

Competitor _____

Team Name _____

Sugar Drop

You are going to estimate the number of sugar cubes that will fit into a pint sized container and then use problem solving strategies to find the actual volume of sugar cubes needed. You may not touch the materials until you have written your estimate below. When you find the actual volume of the container, record your results and find the difference between the two numbers. Remember, the object is to get as close to the actual number of cubes as possible. Think about the processes you used to solve this problem and answer the questions below.

Estimate

3

_____ cm

Actual

3

_____ cm

Score (difference)

3

_____ cm

1. Write an explanation of the method you used to determine your estimate.

2. How does your estimate compare to your actual answer?

3. How do you explain the difference between the two numbers?

4. How did you get the actual volume? Is there an easier way to determine the volume? Explain.

Competitor _____

Team Name _____

Dare to Dribble

In this activity, you are going to estimate the number of times that you can bounce a ball in one minute. After you record your estimate, ask a partner to keep time and count the number of bounces. Record your bounces below and find the difference between the two numbers. Read and answer the questions following the activity carefully.

EstimateActualScore (difference)

_____ bounces

_____ bounces

_____ bounces

1. Write a number sentence that represents the difference between your estimate and actual answer.

2. Make a list or table of variables or factors that could increase or decrease the actual outcome.

Competitor _____

Team Name _____

Long Jump

In this event, you are going to jump as far as you can from a standing position. Stand at the starting line and estimate how far you think you can jump. Record your guess below. Jump with both feet from the starting line and have a partner mark the distance with a piece of tape. Use the materials provided to measure your jump to the nearest centimeter and record it. After you calculate the difference, answer the reflection questions.

EstimateActualScore (difference)

_____ cm

_____ cm

_____ cm

1. What factors do you think may have influenced the length of your jump?

2. If you repeated your jump, would there be a different outcome? Justify or explain your answer.

Competitor _____

Team Name _____

High Five

In this event, you will be using your knowledge of area to determine the area in square units of your hand. We will be using this information for another activity later in the week as well. Place just your thumb on the piece of graph paper. Estimate how many square units are in the area of your thumb. Based on that estimate, record an estimate for the area of your entire hand without putting your hand on the graph paper. When your estimate is recorded, trace your hand onto the graph paper. You may use any method to calculate the actual area. Be sure to record the actual area and the difference below before you answer the questions following this event.

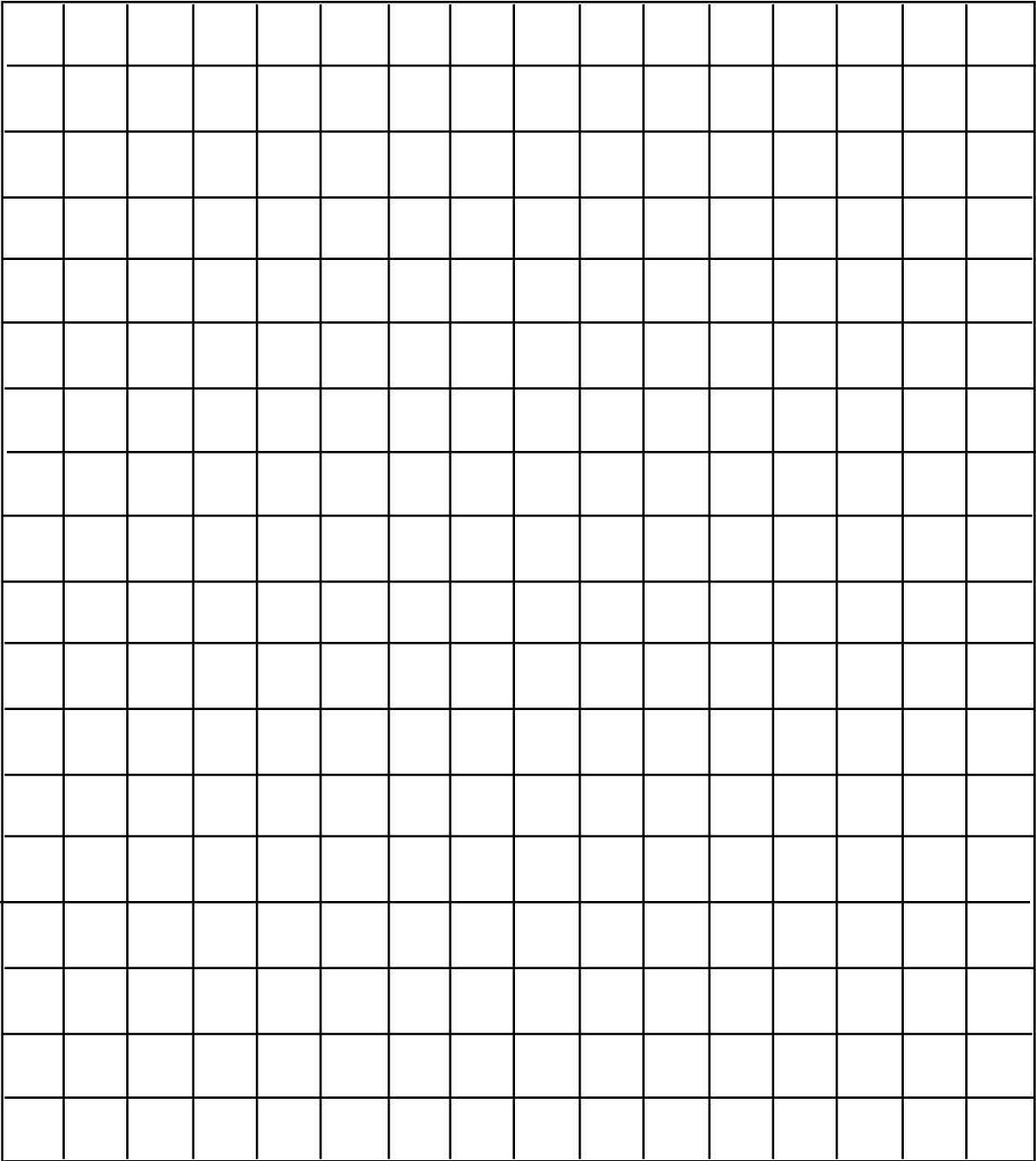
<u>Thumb Estimate</u>	<u>Hand Estimate</u>	<u>Actual</u>	<u>Score (difference)</u>
_____ ² _____ cm	_____ ² _____ cm	_____ ² _____ cm	_____ ² _____ cm

1. How did you determine your estimate for this problem?

2. Explain the strategy that you used to determine your actual answer.

3. Was your actual answer close to your estimate? How can you explain your results?

CENTIMETER GRAPH PAPER for "HIGH FIVE"



Competitor _____

Team Name _____

Olympic Medal Weight

In this event, you are going to estimate the weight of a number of silver and bronze "medals". Based on your knowledge of what one "medal" weighs, how much do you think the medals at this station weigh? Make an estimate for both the bronze and silver medals and then weigh them using the materials provided. Be sure to measure and record accurately, then answer the questions following the activity.

	<u>Estimate</u>	<u>Actual</u>	<u>Score (difference)</u>
bronze	_____g	_____g	_____g
silver	_____g	_____g	_____g

1. Write an explanation of the method you used to determine your estimate.

2. Explain the process you used to determine the actual weight.

3. Write a number sentence to explain the difference between the two numbers in either trial.

Competitor _____

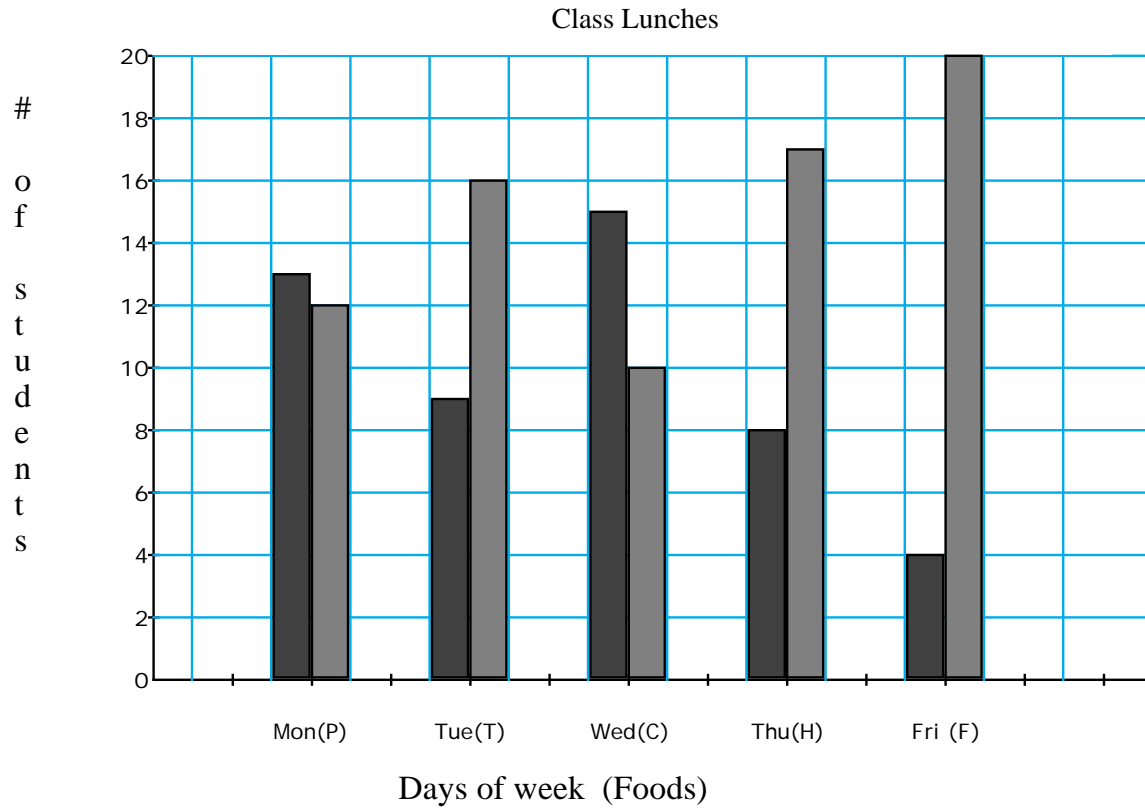
Team Name _____

Final Score Sheet

Event	Estimate	Actual	Score (Difference)
#1 Sugar Drop	cm ³	cm ³	cm ³
#2 High Five	cm ²	cm ²	cm ²
#3 Dare To Dribble	bounces	bounces	bounces
#4 Long Jump	cm	cm	cm
#5 Olympic Medal Wt.	g	g	g
Olympic Medal Wt.	g	g	g

TOTAL _____

Sample Double Bar Graph



Dark - Cafeteria Lunches

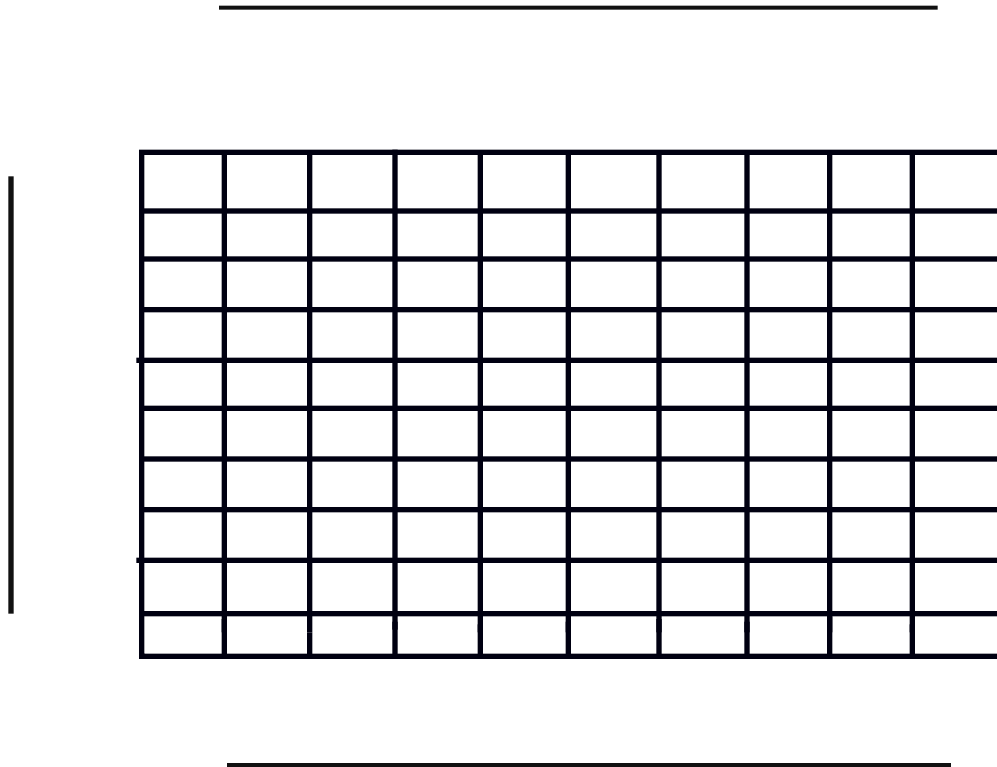
Light - Bag Lunches

**K
E
Y**

Competitor_____ Team Name_____

Double Bar Graph Template

Directions: Using the data collected in the games, create a double bar graph to represent the estimated and actual measurements.

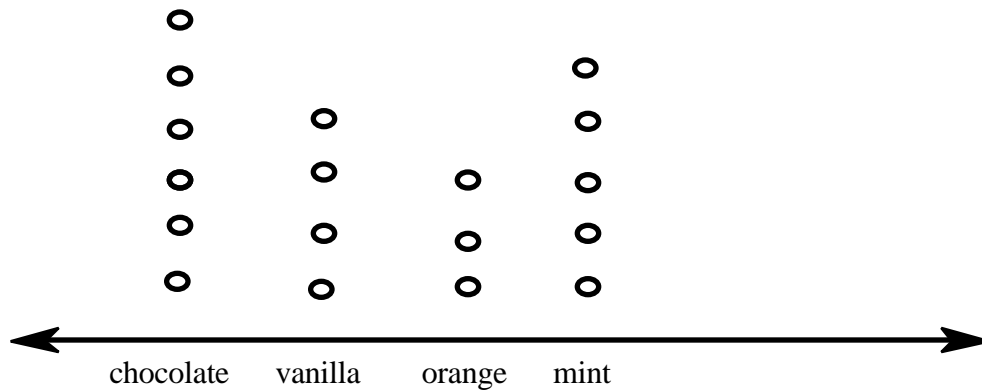


On the lines provided below, explain what the data on your double bar graph represents.

Key

Sample Line Plot

Favorite Ice Cream Flavors



Key

○ = 4 people

Competitor _____

Team Name _____

Writing a Friendly Letter

Write a letter to your teacher, the representative to the Olympic committee, to inform her about how estimating is a useful mathematical tool and life skill. Include at least three reasons or examples. Support your statements with examples from the events you just completed or other evidence.

- Think about how you can apply estimation in a real life setting.
- Think about why estimation is a helpful strategy.
- Think about who else might use estimation.
- Think about the estimations strategies you applied while completing the events of the last few days.

Be sure to include all of the elements of a friendly letter in your final draft. Proofread for correct spelling, punctuation, and capitalization.

Rubric for Writing a Friendly Letter

FOUR POINTS:

- Uses correct letter format, including all five parts.
- Identifies appropriate audience.
- Maintains topic focus.
- Identifies paragraphs through indentation.
- Thoroughly develops paragraphs, including three examples.
- Consistently uses correct grammar, mechanics, and spelling.

THREE POINTS:

- Uses correct letter format, including all five parts.
- Shows audience awareness.
- Maintains topic focus.
- Identifies paragraphs through indentation.
- Thoroughly develops paragraphs, including at least two examples.
- Uses correct grammar, mechanics, and spelling with very few mistakes.

TWO POINTS:

- Omitted one part of the friendly letter format.
- Shows audience awareness.
- Generally focuses on topic.
- Indents paragraphs but does not fully develop using examples.
- Several mistakes observed in grammar, mechanics, and spelling.

ONE POINT:

- Omitted more than one part of correct letter format.
- Shows little audience awareness.
- Little topic focus displayed.
- Paragraphs lack development of ideas and are not indented.
- Infrequent use of correct grammar, mechanics, and spelling.

TEAM _____

Glyph Construction Rubric

FOUR POINTS

- All data is accurate.
- Correct symbols are used.
- Glyph is neat and readable.

THREE POINTS

- One piece of inaccurate data was collected or recorded.
- One symbol was recorded incorrectly.
- Glyph is readable.

TWO POINTS

- Two or more pieces of inaccurate data was collected or recorded.
- Two symbols were recorded incorrectly.
- Glyph is sloppy and difficult to read.

ONE POINT

- Glyph is incomplete.
- Glyph is not readable.

TEAM _____

SCORING RUBRIC for GROUP INTERACTION

FOUR POINTS

- Each member of the group did his/her job.
- Correct behavior was displayed.
- The group completed all tasks.
- Work is neat and readable.

THREE POINTS

- Each member of the group did his/her job with a little redirection.
- Correct behavior was displayed.
- The group completed all tasks.
- Work is neat and readable.

TWO POINTS

- Each member of the group did his/her job with redirection.
- Satisfactory behavior was displayed.
- The group completed more than eighty percent of the tasks.
- Work is difficult to read.

ONE POINT

- Each member of the group was frequently off task.
- Poor behavior was displayed.
- The group completed eighty percent of the task.
- Work is sloppy and not readable.